

SNx4HC244 Octal Buffers and Line Drivers With 3-State Outputs

1 Features

- Wide operating voltage range of 2V to 6V
- High-current outputs drive up to 15 LSTTL loads
- 3-state outputs drive bus lines or buffer memory address registers
- Low power consumption: I_{CC} , 80 μ A (maximum)
- Typical t_{pd} = 11ns
- ± 6 mA output drive at 5V
- Low input current of 1 μ A (maximum)
- On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

2 Applications

- Servers
- LED Displays
- Network Switches
- Telecom Infrastructure
- Motor Drivers
- I/O Expanders

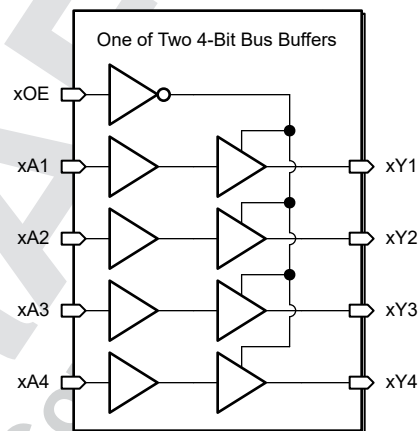
3 Description

The SNx4HC244 octal buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The SNx4HC244 devices are organized as two 4-bit buffers and drivers with separate output-enable (\overline{OE}) inputs. When \overline{OE} is low, the device passes noninverted data from the A inputs to the Y outputs. When \overline{OE} is high, the outputs are in the high-impedance state.

Device Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾	BODY SIZE ⁽³⁾
SN54HC244	J (CDIP, 20)	24.38mm × 7.62mm	24.38mm × 6.92mm
	W (CFP, 20)	13.72mm × 8.13mm	13.72mm × 6.92mm
	FK (LCCC, 20)	8.89mm × 8.89mm	8.89mm × 8.89mm
SN74HC244	DB (SSOP, 20)	7.2mm × 7.8mm	7.2mm × 5.3mm
	DW (SOIC, 20)	12.80mm × 10.3mm	12.8mm × 7.5mm
	N (PDIP, 20)	24.33mm × 9.4mm	24.33mm × 6.35mm
	NS (SOP, 20)	12.6mm × 7.8mm	12.6mm × 5.3mm
	PW (TSSOP, 20)	6.5mm × 6.4mm	6.5mm × 4.4mm

- (1) For more information, see [Mechanical, Packaging, and Orderable Information](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



Logic Diagram (Positive Logic)



Table of Contents

1 Features	1	7.1 Overview.....	14
2 Applications	1	7.2 Functional Block Diagram.....	14
3 Description	1	7.3 Feature Description.....	14
4 Pin Configuration and Functions	3	7.4 Device Functional Modes.....	14
5 Specifications	4	8 Application and Implementation	16
5.1 Absolute Maximum Ratings.....	4	8.1 Application Information.....	16
5.2 ESD Ratings.....	4	8.2 Typical Application.....	16
5.3 Recommended Operating Conditions.....	4	8.3 Power Supply Recommendations.....	17
5.4 Thermal Information.....	5	8.4 Layout Guidelines.....	17
5.5 Electrical Characteristics.....	5	9 Device and Documentation Support	19
5.6 Electrical Characteristics – -55 – 125 C.....	5	9.1 Documentation Support.....	19
5.7 Electrical Characteristics – -40 – 125 C.....	6	9.2 Receiving Notification of Documentation Updates.....	19
5.8 Electrical Characteristics – -40 – 85 C.....	6	9.3 Support Resources.....	19
5.9 Switching Characteristics.....	7	9.4 Trademarks.....	19
5.10 Switching Characteristics – $C_L = 50$ pF.....	8	9.5 Electrostatic Discharge Caution.....	19
5.11 Switching Characteristics – $C_L = 150$ pF.....	10	9.6 Glossary.....	19
5.12 Typical Characteristic.....	11	10 Revision History	19
6 Parameter Measurement Information	12	11 Mechanical, Packaging, and Orderable Information	20
7 Detailed Description	14		

4 Pin Configuration and Functions

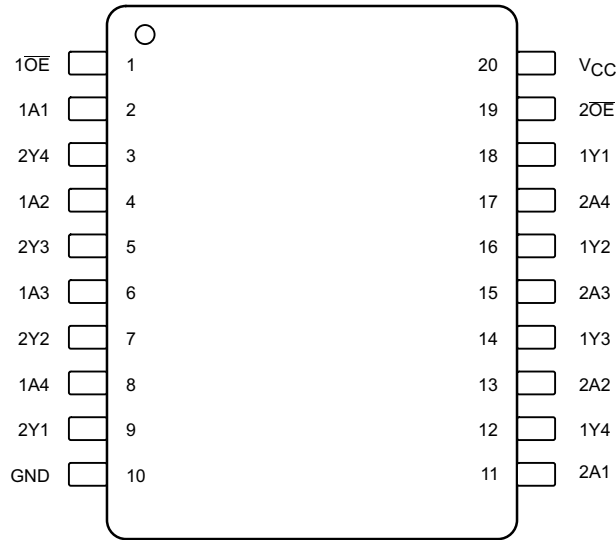


Figure 4-1. DB, DW, J, N, NS, PW, W Package 20-Pin SSOP, SOIC, CDIP, PDIP, SOP, TSSOP, or CFP Top View

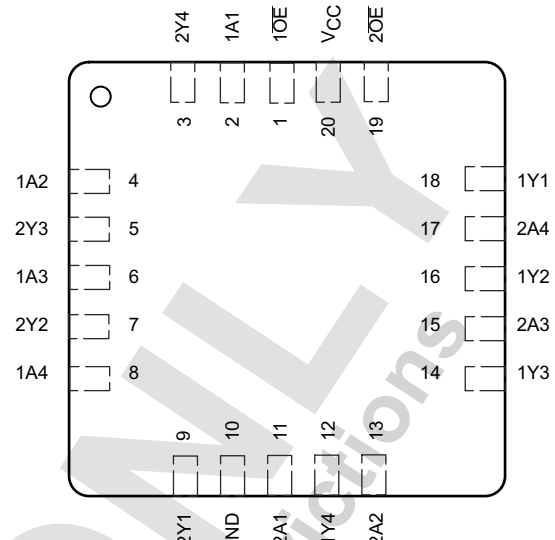


Figure 4-2. FK Package 20-Pin LCCC Top View

PIN		I/O ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	1 \overline{OE}	I	Output Enable
2	1A1	I	Input
3	2Y4	O	Output
4	1A2	I	Input
5	2Y3	O	Output
6	1A3	I	Input
7	2Y2	O	Output
8	1A4	I	Input
9	2Y1	O	Output
10	GND	—	Ground
11	2A1	I	Input
12	1Y4	O	Output
13	2A2	I	Input
14	1Y3	O	Output
15	2A3	I	Input
16	1Y2	O	Output
17	2A4	I	Input
18	1Y1	O	Output
19	2 \overline{OE}	I	Output Enable
20	V _{CC}	—	Power Pin

(1) Signal Types: I = Input, O = Output, I/O = Input or Output.

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
Supply voltage range, V_{CC}		−0.5	7	V
Input clamp current, I_{IK}	$V_I < 0$ or $V_I > V_{CC}$ ⁽²⁾		±20	mA
Output clamp current, I_{OK}	$V_O < 0$ or $V_O > V_{CC}$ ⁽²⁾		±20	mA
Continuous output current, I_O	$V_O = 0$ or V_{CC}		±35	mA
Continuous current through V_{CC} or GND			±70	mA
Junction Temperature, T_J			150	°C
Storage temperature, T_{stg}		−65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

5.2 ESD Ratings

SN74HC244		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	2	5	6	V
V_{IH}	High-level input voltage	$V_{CC} = 2\text{ V}$	1.5		V
		$V_{CC} = 4.5\text{ V}$	3.15		
		$V_{CC} = 6\text{ V}$	4.2		
V_{IL}	Low-level input voltage	$V_{CC} = 2\text{ V}$		0.5	V
		$V_{CC} = 4.5\text{ V}$		1.35	
		$V_{CC} = 6\text{ V}$		1.8	
V_I	Input voltage	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	V
$\Delta t/\Delta v$	Input transition rise and fall time	$V_{CC} = 2\text{ V}$		1000	ns/V
		$V_{CC} = 4.5\text{ V}$		500	
		$V_{CC} = 6\text{ V}$		400	
C_{pd}	Power dissipation capacitance per buffer or driver (no load)		35		pF
T_A	Operating free-air temperature	SN54HC244	−55	125	°C
		SN74HC244	−40	125	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See the Texas Instruments application report, *Implications of Slow or Floating CMOS Inputs*, SCBA004.

5.4 Thermal Information

THERMAL METRIC		SN74HC244					UNIT
		DW (SOIC)	DB (SSOP)	N (PDIP)	NS (SO)	PW (TSSOP)	
		20 PINS	20 PINS	20 PINS	20 PINS	20 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance ⁽¹⁾	109.1	122.7	84.6	113.4	131.8	°C/W
$R_{\theta JC (top)}$	Junction-to-case (top) thermal resistance	76	81.6	72.5	78.6	72.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	77.6	77.5	65.3	78.4	82.8	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	51.5	46.1	55.3	47.1	21.5	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	77.1	77.1	65.2	78.1	82.4	°C/W
$R_{\theta JC (bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	N/A	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

5.5 Electrical Characteristics

$T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu A$	$V_{CC} = 2 \text{ V}$	1.9	1.998	V	
			$V_{CC} = 4.5 \text{ V}$	4.4	4.499		
			$V_{CC} = 6 \text{ V}$	5.9	5.999		
		$I_{OH} = -6 \text{ mA}, V_{CC} = 4.5 \text{ V}$		3.98	4.3		
		$I_{OH} = -7.8 \text{ mA}, V_{CC} = 6 \text{ V}$		5.48	5.8		
V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu A$	$V_{CC} = 2 \text{ V}$		0.002	0.1	V
			$V_{CC} = 4.5 \text{ V}$		0.001	0.1	
			$V_{CC} = 6 \text{ V}$		0.001	0.1	
		$I_{OL} = 6 \text{ mA}, V_{CC} = 4.5 \text{ V}$			0.17	0.26	
		$I_{OL} = 7.8 \text{ mA}, V_{CC} = 6 \text{ V}$			0.15	0.26	
I_I	$V_I = V_{CC} \text{ or } 0, V_{CC} = 6 \text{ V}$				± 0.1	± 100	nA
I_{OZ}	$V_O = V_{CC} \text{ or } 0, V_I = V_{IH} \text{ or } V_{IL}, V_{CC} = 6 \text{ V}$				± 0.01	± 0.5	μA
I_{CC}	$V_I = V_{CC} \text{ or } 0, I_O = 0, V_{CC} = 6 \text{ V}$					8	μA
C_i	$V_{CC} = 2 \text{ V to } 6 \text{ V}$				3	10	pF

5.6 Electrical Characteristics – -55 – 125 C

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V _{OH}	V _I = V _{IH} or V _{IL}	I _{OH} = −20 μA	V _{CC} = 2 V	1.9		V	
			V _{CC} = 4.5 V	4.4			
			V _{CC} = 6 V	5.9			
		I _{OH} = −6 mA, V _{CC} = 4.5 V		3.7			
		I _{OH} = −7.8 mA, V _{CC} = 6 V		5.2			

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	V _{CC} = 2 V			0.1	V
			V _{CC} = 4.5 V			0.1	
			V _{CC} = 6 V			0.1	
		I _{OL} = 6 mA, V _{CC} = 4.5 V				0.4	
		I _{OL} = 7.8 mA, V _{CC} = 6 V				0.4	
I _I	V _I = V _{CC} or 0, V _{CC} = 6 V					±1000	nA
I _{OZ}	V _O = V _{CC} or 0, V _I = V _{IH} or V _{IL} , V _{CC} = 6 V					±10	μA
I _{CC}	V _I = V _{CC} or 0, I _O = 0, V _{CC} = 6 V					160	μA
C _i	V _{CC} = 2 V to 6 V					10	pF

5.7 Electrical Characteristics – -40 – 125 C

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu A$	$V_{CC} = 2 \text{ V}$	1.9			V
			$V_{CC} = 4.5 \text{ V}$	4.4			
			$V_{CC} = 6 \text{ V}$	5.9			
		$I_{OH} = -6 \text{ mA}, V_{CC} = 4.5 \text{ V}$		3.7			
		$I_{OH} = -7.8 \text{ mA}, V_{CC} = 6 \text{ V}$		5.2			
V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu A$	$V_{CC} = 2 \text{ V}$			0.1	V
			$V_{CC} = 4.5 \text{ V}$			0.1	
			$V_{CC} = 6 \text{ V}$			0.1	
		$I_{OL} = 6 \text{ mA}, V_{CC} = 4.5 \text{ V}$				0.4	
		$I_{OL} = 7.8 \text{ mA}, V_{CC} = 6 \text{ V}$				0.4	
I_I	$V_I = V_{CC} \text{ or } 0, V_{CC} = 6 \text{ V}$					± 1000	nA
I_{OZ}	$V_O = V_{CC} \text{ or } 0, V_I = V_{IH} \text{ or } V_{IL}, V_{CC} = 6 \text{ V}$					± 10	μA
I_{CC}	$V_I = V_{CC} \text{ or } 0, I_O = 0, V_{CC} = 6 \text{ V}$					160	μA
C_i	$V_{CC} = 2 \text{ V to } 6 \text{ V}$					10	pF

5.8 Electrical Characteristics – -40 – 85 C

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu A$	$V_{CC} = 2 V$	1.9			V
			$V_{CC} = 4.5 V$	4.4			
			$V_{CC} = 6 V$	5.9			
		$I_{OH} = -6 \text{ mA}, V_{CC} = 4.5 V$		3.84			
		$I_{OH} = -7.8 \text{ mA}, V_{CC} = 6 V$		5.34			
V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu A$	$V_{CC} = 2 V$			0.1	V
			$V_{CC} = 4.5 V$			0.1	
			$V_{CC} = 6 V$			0.1	
		$I_{OL} = 6 \text{ mA}, V_{CC} = 4.5 V$				0.33	
		$I_{OL} = 7.8 \text{ mA}, V_{CC} = 6 V$				0.33	
I_I	$V_I = V_{CC} \text{ or } 0, V_{CC} = 6 V$					± 1000	nA
I_{OZ}	$V_O = V_{CC} \text{ or } 0, V_I = V_{IH} \text{ or } V_{IL}, V_{CC} = 6 V$					± 5	μA
I_{CC}	$V_I = V_{CC} \text{ or } 0, I_O = 0, V_{CC} = 6 V$					80	μA

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_i	$V_{CC} = 2\text{ V to }6\text{ V}$			10	pF

5.9 Switching Characteristics

$T_A = 25^\circ\text{C}$ (unless otherwise noted; see [Figure 6-1](#))

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	$V_{CC} = 2\text{ V}$	$C_L = 50\text{ pF}$	40	115	ns
			$C_L = 150\text{ pF}$	56	165	
		$V_{CC} = 4.5\text{ V}$	$C_L = 50\text{ pF}$	13	23	
			$C_L = 150\text{ pF}$	18	33	
		$V_{CC} = 6\text{ V}$	$C_L = 50\text{ pF}$	11	20	
			$C_L = 150\text{ pF}$	15	28	
t_{en}	From \overline{OE} (input) to Y (output)	$V_{CC} = 2\text{ V}$	$C_L = 50\text{ pF}$	75	150	ns
			$C_L = 150\text{ pF}$	100	200	
		$V_{CC} = 4.5\text{ V}$	$C_L = 50\text{ pF}$	15	30	
			$C_L = 150\text{ pF}$	20	40	
		$V_{CC} = 6\text{ V}$	$C_L = 50\text{ pF}$	13	26	
			$C_L = 150\text{ pF}$	17	34	
t_{dis}	From \overline{OE} (input) to Y (output)	$V_{CC} = 2\text{ V}$	$C_L = 50\text{ pF}$	75	150	ns
		$V_{CC} = 4.5\text{ V}$	$C_L = 50\text{ pF}$	15	30	
		$V_{CC} = 6\text{ V}$	$C_L = 50\text{ pF}$	13	26	
t_t	To Y (output)	$V_{CC} = 2\text{ V}$	$C_L = 50\text{ pF}$	28	60	ns
			$C_L = 150\text{ pF}$	45	210	
		$V_{CC} = 4.5\text{ V}$	$C_L = 50\text{ pF}$	8	12	
			$C_L = 150\text{ pF}$	17	42	
		$V_{CC} = 6\text{ V}$	$C_L = 50\text{ pF}$	6	10	
			$C_L = 150\text{ pF}$	13	36	

5.10 Switching Characteristics – $C_L = 50 \text{ pF}$

over recommended operating free-air temperature range (unless otherwise noted; see [Figure 6-1](#))

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	$V_{CC} = 2 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		170	ns
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		170	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		145	
		$V_{CC} = 4.5 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		34	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		34	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		29	
		$V_{CC} = 6 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		29	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		29	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		25	
t_{en}	From \overline{OE} (input) to Y (output)	$V_{CC} = 2 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		225	ns
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		225	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		190	
		$V_{CC} = 4.5 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		45	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		45	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		38	
		$V_{CC} = 6 \text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		38	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		38	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		32	

over recommended operating free-air temperature range (unless otherwise noted; see [Figure 6-1](#))

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{dis}	From \overline{OE} (input) to Y (output)	$V_{CC} = 2\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		225	ns
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		225	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		190	
		$V_{CC} = 4.5\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		45	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		45	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		38	
		$V_{CC} = 6\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		38	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		38	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		32	
t_t	To Y (output)	$V_{CC} = 2\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		90	ns
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		90	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		75	
		$V_{CC} = 4.5\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		18	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		18	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		15	
		$V_{CC} = 6\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$		15	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$		15	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		13	

5.11 Switching Characteristics – $C_L = 150 \text{ pF}$

over recommended operating free-air temperature range (unless otherwise noted; see [Figure 6-1](#))

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	$V_{CC} = 2 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		245	ns
			$T_A = -40^\circ\text{C}$ to 125°C		245	
			$T_A = -40^\circ\text{C}$ to 85°C		210	
		$V_{CC} = 4.5 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		49	
			$T_A = -40^\circ\text{C}$ to 125°C		49	
			$T_A = -40^\circ\text{C}$ to 85°C		42	
		$V_{CC} = 6 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		42	
			$T_A = -40^\circ\text{C}$ to 125°C		42	
			$T_A = -40^\circ\text{C}$ to 85°C		35	
t_{en}	From \overline{OE} (input) to Y (output)	$V_{CC} = 2 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		300	ns
			$T_A = -40^\circ\text{C}$ to 125°C		300	
			$T_A = -40^\circ\text{C}$ to 85°C		250	
		$V_{CC} = 4.5 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		60	
			$T_A = -40^\circ\text{C}$ to 125°C		60	
			$T_A = -40^\circ\text{C}$ to 85°C		50	
		$V_{CC} = 6 \text{ V}$	$T_A = -55^\circ\text{C}$ to 125°C		51	
			$T_A = -40^\circ\text{C}$ to 125°C		51	
			$T_A = -40^\circ\text{C}$ to 85°C		43	

over recommended operating free-air temperature range (unless otherwise noted; see [Figure 6-1](#))

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_t	To Y (output)	$V_{CC} = 2\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$			315	ns
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$			315	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			265	
		$V_{CC} = 4.5\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$			63	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$			63	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			53	
		$V_{CC} = 6\text{ V}$	$T_A = -55^\circ\text{C to } 125^\circ\text{C}$			53	
			$T_A = -40^\circ\text{C to } 125^\circ\text{C}$			53	
			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			45	

5.12 Typical Characteristic

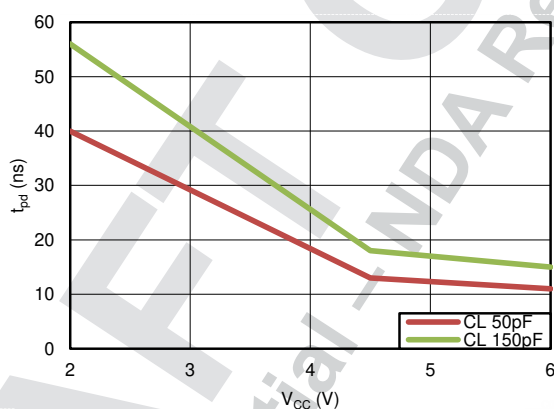


Figure 5-1. Propagation Delay

6 Parameter Measurement Information

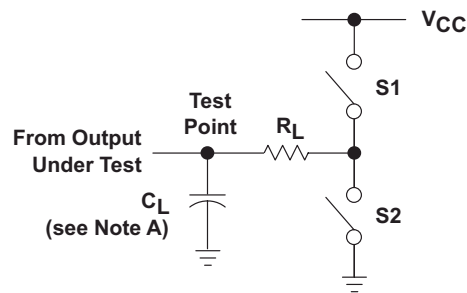


Figure 6-1. Load Circuit

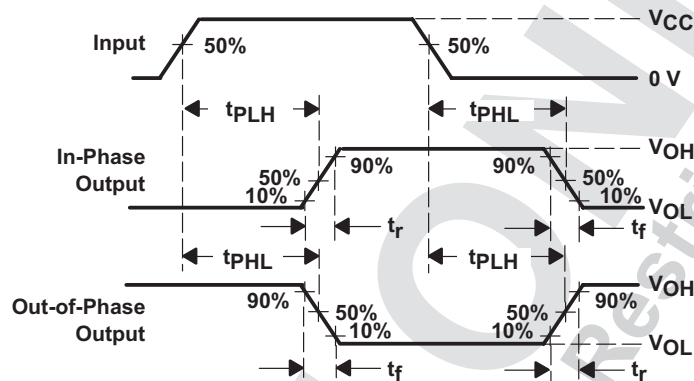


Figure 6-2. Propagation Delay and Output Transition Times



Figure 6-3. Input Rise and Fall Times

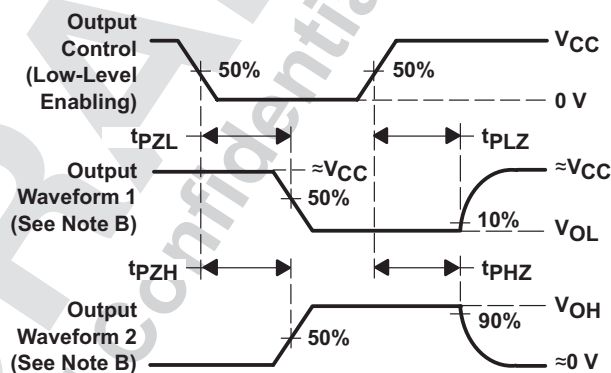


Figure 6-4. Enable and Disable Times for 3-State Outputs

Note

NOTE:

- A. C_L includes probe and test-fixture capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Table 6-1. Switching Information Table

PARAMETER		RL	CL	S1	S2
t_{en}	t_{PZH}	1 k Ω	50 pF or 150 pF	Open	Closed
	t_{PZL}	1 k Ω	50 pF or 150 pF	Closed	Open
t_{dis}	t_{PHZ}	1 k Ω	50 pF	Open	Closed
	t_{PLZ}	1 k Ω	50 pF	Closed	Open
t_{pd} or t_t		—	50 pF or 150 pF	Open	Open

7 Detailed Description

7.1 Overview

The SNx4HC244 contains 8 individual high speed CMOS buffers with Schmitt-trigger inputs and 3-state outputs.

Each buffer performs the boolean logic function $xY_n = xA_n$, with x being the bank number and n being the channel number.

Each output enable ($x\overline{OE}$) controls four buffers. When the $x\overline{OE}$ pin is in the low state, the outputs of all buffers in the bank x are enabled. When the $x\overline{OE}$ pin is in the high state, the outputs of all buffers in the bank x are disabled. All disabled output are placed into the high-impedance state.

To put the device in the high-impedance state during power up or power down, tie both \overline{OE} pins to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current sinking capability of the driver and the leakage of the pin as defined in the *Electrical Characteristics* table.

7.2 Functional Block Diagram

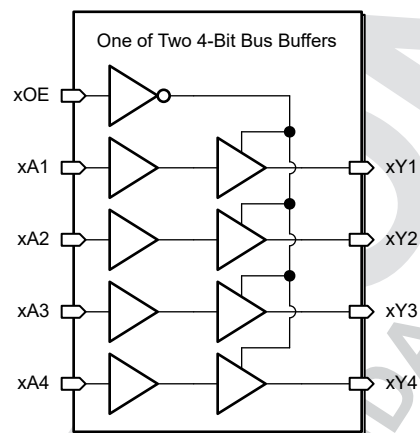


Figure 7-1. Logic Diagram (Positive Logic)

7.3 Feature Description

7.3.1 Standard CMOS Inputs

This device includes standard CMOS inputs. Standard CMOS inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics*. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings*, and the maximum input leakage current, given in the *Electrical Characteristics*, using Ohm's law ($R = V \div I$).

Standard CMOS inputs require that input signals transition between valid logic states quickly, as defined by the input transition time or rate in the *Recommended Operating Conditions* table. Failing to meet this specification will result in excessive power consumption and could cause oscillations. More details can be found in [Implications of Slow or Floating CMOS Inputs](#).

Do not leave standard CMOS inputs floating at any time during operation. Unused inputs must be terminated at V_{CC} or GND. If a system will not be actively driving an input at all times, then a pull-up or pull-down resistor can be added to provide a valid input voltage during these times. The resistor value will depend on multiple factors; a 10kΩ resistor, however, is recommended and will typically meet all requirements.

7.4 Device Functional Modes

[Table 7-1](#) lists the functional modes of the SNx4HC244.

Table 7-1. Function Table

INPUTS ⁽¹⁾		OUTPUTS
\overline{OE}	A	Y
L	L	L
L	H	H
H	X	Z

(1) H = High Voltage Level, L = Low Voltage Level, X = Do Not Care, Z = High-Impedance State

8 Application and Implementation

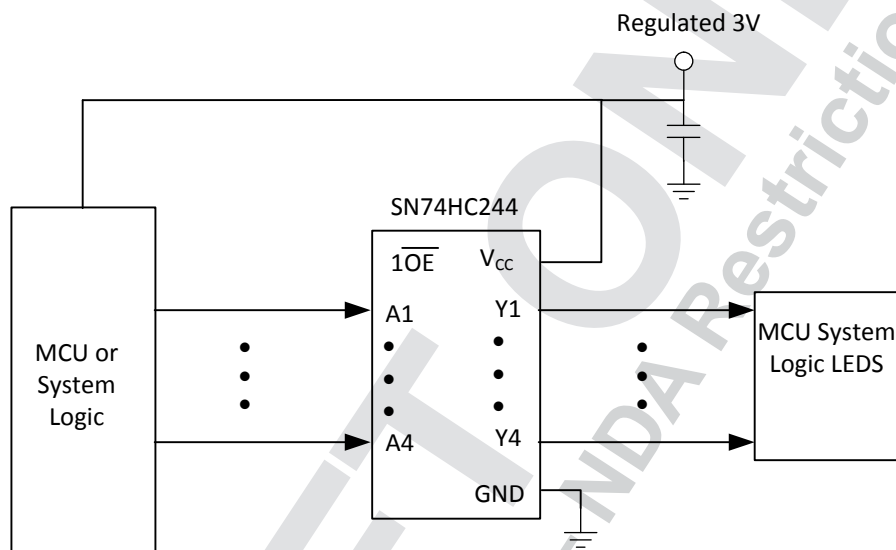
Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

SN74HC244 is a high-drive CMOS device that can be used for a multitude of bus interface type applications where output drive or PCB trace length is a concern.

8.2 Typical Application



Copyright © 2016, Texas Instruments Incorporated

Figure 8-1. SN74HC244 Application Schematic

8.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive also creates fast edges into light loads so routing and load conditions should be considered to prevent ringing.

8.2.2 Detailed Design Procedure

1. Recommended input conditions:
 - For rise time and fall time specifications, see $\Delta t/\Delta V$ in [Section 5.3](#).
 - For specified high and low levels, see V_{IH} and V_{IL} in [Section 5.3](#).
2. Recommend output conditions:
 - Load currents should not exceed I_O max per output and should not exceed the continuous current through V_{CC} or GND total current for the part. These limits are located in [Section 5.1](#).
 - Outputs should not be pulled above V_{CC} .

8.2.3 Application Curve

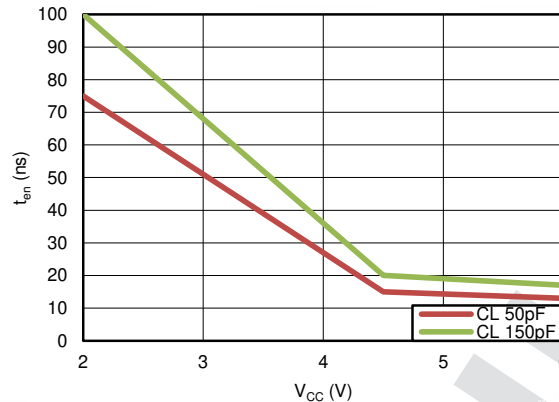


Figure 8-2. Enable Time

8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. A $0.1\mu F$ capacitor is recommended for this device. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. The $0.1\mu F$ and $1\mu F$ capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

8.4 Layout Guidelines

- Bypass capacitor placement
 - Place near the positive supply terminal of the device
 - Provide an electrically short ground return path
 - Use wide traces to minimize impedance
 - Keep the device, capacitors, and traces on the same side of the board whenever possible
- Signal trace geometry
 - 8mil to 12mil trace width
 - Lengths less than 12cm to minimize transmission line effects
 - Avoid 90° corners for signal traces
 - Use an unbroken ground plane below signal traces
 - Flood fill areas around signal traces with ground
 - For traces longer than 12cm
 - Use impedance controlled traces
 - Source-terminate using a series damping resistor near the output
 - Avoid branches; buffer signals that must branch separately

8.4.1 Layout Example

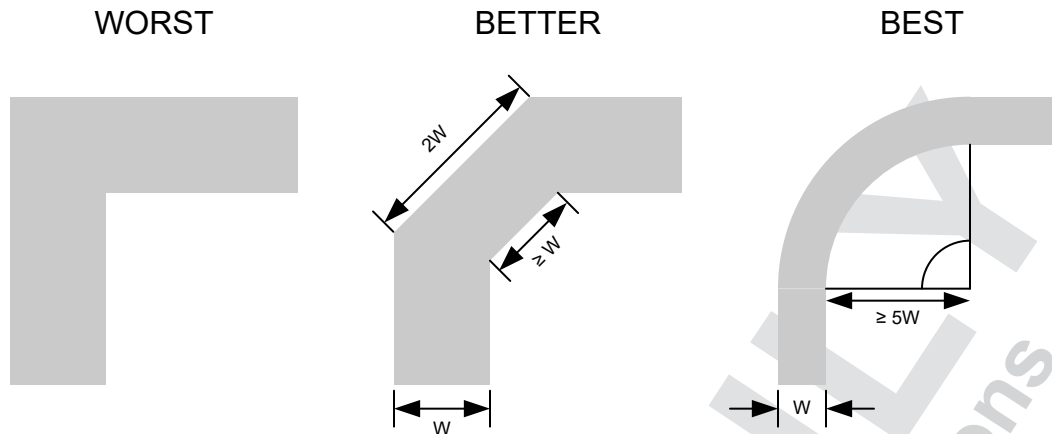


Figure 8-3. Example Trace Corners for Improved Signal Integrity

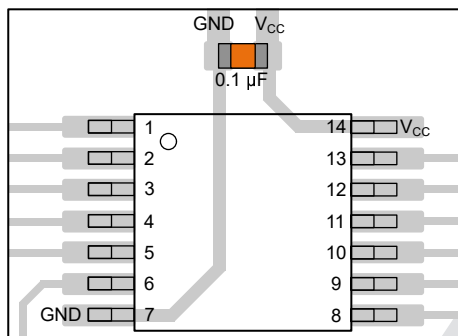


Figure 8-4. Example Bypass Capacitor Placement for TSSOP and Similar Packages

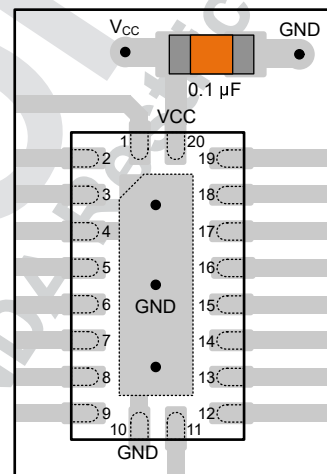


Figure 8-5. Example Bypass Capacitor Placement for WQFN and Similar Packages

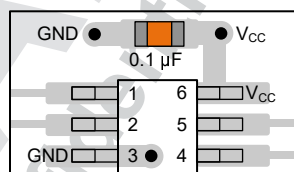


Figure 8-6. Example Bypass Capacitor Placement for SOT, SC70 and Similar Packages

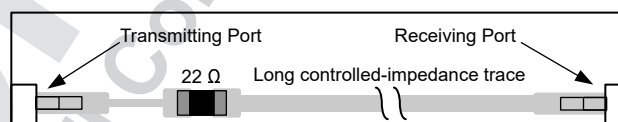


Figure 8-7. Example Damping Resistor Placement for Improved Signal Integrity

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Links

Table 9-1 lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 9-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54HC244	Click here	Click here	Click here	Click here	Click here
SN74HC244	Click here	Click here	Click here	Click here	Click here

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.3 Support Resources

TI E2E™ [support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

9.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision G (January 2025) to Revision H (February 2025) Page

- Updated SN74HC244 operating temperature to 125°C and respective values in *Electrical Characteristics* table, *Recommended Operating Conditions* table, and *Switching Characteristics* tables..... **1**

Changes from Revision F (May 2022) to Revision G (January 2025) Page

- Added package size to *Device Information* table and updated structural layout of data sheet to current standards..... **1**
- Updated *Features Description* and corrected *Functional Block Diagram* image and *Device Functional Modes* table **14**

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

DRAFT ONLY
TI Confidential – NDA Restrictions

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2025, Texas Instruments Incorporated